

REMARKS/ARGUMENTS

The claims are 1, 2 and 4-6 which were rejected under 35 U.S.C. 103(a) as being unpatentable over *Tjoa et al. U.S. Patent No. 3,767,766* in view of *Heisel et al. U.S. Patent No. 5,628,977* and *Keller et al. U.S. Patent Application Publication No. 2002/0134706*. Although the Examiner previously indicated that claim 1 would be allowable, the newly-cited reference *Keller et al.* has been used in combination with *Tjoa et al.* and *Heisel et al.* for the feature of a boiler lined with a refractory material, lying horizontally, to be used as the Claus boiler which has a combustion chamber and a catalyst chamber having a catalyst bulk material, which follows horizontally and being delimited on both sides by gas-permeable checker bricks.

This rejection is respectfully traversed.

As set forth in claim 1, Applicant's invention provides a method for isolating hydrogen sulfide from coke oven gas with subsequent recovery of elemental sulfur in a Claus plant, in which method the hydrogen sulfide is removed from the coke oven

gas by means of gas scrubbing with an absorption liquid, the charged absorption liquid is regenerated, and hydrogen sulfide that occurs in concentrated form in this connection is passed to the Claus plant. The purified coke oven gas can be passed for further use.

In the Claus plant, a known Claus process is carried out, in which the hydrogen sulfide is combusted with oxygen in a Claus boiler, and reacted, forming elemental sulfur. The elemental sulfur that has been formed is then precipitated by means of cooling, whereby residual contents of hydrogen sulfide (H_2S) and sulfur dioxide (SO_2) are catalytically reacted to form sulfur.

As recited in Applicant's claim 1, the Claus plant is operated with only a single reaction oven with a working temperature set in this oven of less than 250°C . The process gas that leaves the reaction oven, after precipitation of the condensed sulfur, is passed back into the coke oven gas to be cleaned, ahead of gas scrubbing, with a residual content of hydrogen sulfide that was not converted in the reaction oven. A boiler lined with a refractory material, lying horizontally, is

used as the Claus boiler, which has a combustion chamber and a catalyst chamber having a catalyst bulk material, which follows horizontally and is delimited on both sides by gas-permeable checker bricks.

The primary reference to *Tjoa et al.* discloses a method for the precipitation of H_2S from an absorption fluid. With reference to the single figure of *Tjoa et al.*, it is described that the H_2S that is formed can be passed to a Claus boiler. See column 9, lines 37 to 40. Implementation of the Claus method and the characteristics recited in Applicant's claim 1 with reference to such implementation are nowhere disclosed or suggested in *Tjoa et al.*

For example *Tjoa et al.* particularly fails to disclose or suggest that only one reaction oven is used, which is operated at a temperature of less than $250^{\circ}C$, whereby the gas that leaves the reaction oven, with the H_2S contained in it, is passed back to the preceding gas scrubber, and whereby the Claus boiler is disposed to lie horizontally, and contains a catalyst material as a loose bulk material, between gas-permeable checker bricks.

Although the secondary reference to *Heisel et al.* uses only a single reaction oven, the only thing emphasized in *Heisel et al.* as being essential is that SO_2 is removed after the reaction oven, by means of gas scrubbing, and then directly passed back to the Claus boiler. *Heisel et al.* proceeds from the assumption that in a usual Claus process, H_2S is reacted with oxygen, together with the other ingredients such as SO_2 , in a stoichiometric ratio, so that complete reaction of the sulfur is possible. See column 3, lines 1 to 10 of *Heisel et al.* As an alternative, *Heisel et al.* proposes to produce SO_2 in excess, and then to conduct it in a circuit. See column 3, lines 12 to 24. It is explicitly not an aim to optimize the combustion process. See column 2, lines 55 to 61 of *Heisel et al.* The post-combustion, the subsequent washing-out of SO_2 , and the feeding back of SO_2 , is therefore absolutely required with the arrangement taught by *Heisel et al.*, and represents the core of the teaching disclosed in *Heisel et al.*

Applicant would also like to emphasize that sulfur dioxide, in other words SO_2 , is provided in excess in *Heisel et al.*, and is fed back in a return line 5. In contrast, with Applicant's

method as recited in claim 1, a gas stream that contains hydrogen sulfide, in other words H_2S , is intended to be passed back into the coke oven gas that is to be purified. It is respectfully submitted that *Heisel et al.* is unable to make such return of H_2S obvious. Even if, proceeding from *Heisel et al.*, one were to pass the stream of gas that leaves the reaction oven back into a coke oven gas that is to be purified, satisfactory sulfur removal would not be expected, because then, according to *Heisel et al.*, this stream of gas would contain a great excess of SO_2 , which could not easily be removed to the desired degree in a gas scrubbing process optimized for the removal of H_2S .

The newly-cited reference to *Keller et al.* is further afield as it discloses a completely different functional principle. No Claus method is carried out in *Keller et al.*. See, in particular, paragraph [0028] at page 4, lines 2-5 of *Keller et al.*, whereby merely a very short contact between the gas mixture that is fed in and the catalyst is supposed to take place. Because, according to *Keller et al.*, specifically no Claus process is supposed to be carried out, and only very brief contact between the catalyst and the gas is provided, during

which chemical equilibrium cannot take place, no catalyst bulk material within a catalyst chamber delimited by checker bricks is provided. Instead, thin layers or mats (see paragraph [0051] of *Keller et al.*) are suspended in the apparatus. The catalyst mats are rigid structures that fill up the entire diameter.

With respect to the horizontal alignment of the Claus boiler as recited in originally-filed claim 3 and incorporated into claim 1, it is respectfully submitted that *Keller et al.* does not have a combustion chamber. The gases are merely fed in, in the warm state, and subsequently reacted in purely catalytic manner. The placement of checker bricks is neither disclosed nor practical with *Keller et al.*'s arrangement. A thin delimitation is sufficient with *Keller et al.*'s system because no combustion takes place and thus there is no risk that flames will pass through. In addition, it is respectfully submitted that a person skilled in the art will necessarily make thin catalyst mats available as a complete unit, so that this person will not provide checker bricks for this purpose.

In addition to specifically intending not to relate to a Claus process, *Keller et al.* makes clear that the method

described therein is not supposed to relate to the washing out of H_2S by means of an absorption fluid and regeneration of the absorption fluid as recited in Applicant's claim 1. See paragraph [0028] at page 4, left column lines 9-15 of *Keller et al.*, in which it is stated:

"The present process does not rely on selectively absorbing H_2S from streams using alkanolamine solutions, boiling the H_2S out of the alkanolamine solution, and then converting the H_2S to elemental sulfur in a Claus sulfur recovery/tail gas treating unit. By substituting a sulfur removal system including the process of the present invention for a conventional sulfur removal unit, a plant that incorporates the new process can be built more compactly and economically, and can be maintained at less cost than a conventional plant employing an amine/sulfur complex." (Emphasis added)

In addition, the method disclosed by *Keller et al.* is based on a different chemical reaction. See page 4, left column, lines 2 to 5 of *Keller et al.* For example, H_2S is specifically not combusted to form SO_2 . The *Heisel et al.* process specifically concerns itself with recycling of SO_2 , so that a combination of *Heisel et al.* with *Keller et al.* is not possible even from a technical point of view.

Thus, it is respectfully submitted that one skilled in the art would have no reason to make the combination suggested by the Examiner, and even if one were to combine the references as hypothetically proposed, one would still not achieve Applicant's method as recited in claim 1.

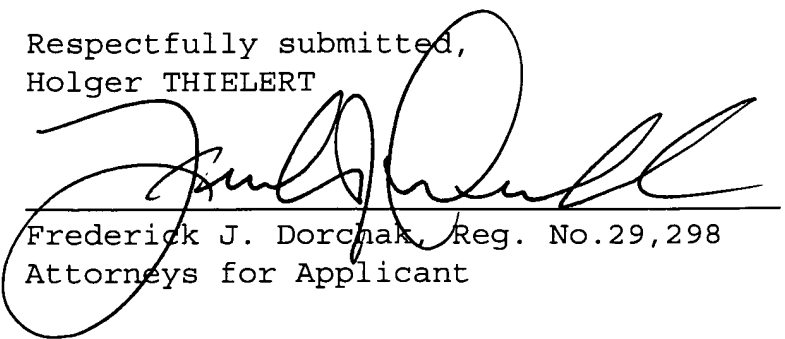
Accordingly, it is respectfully submitted that claim 1, together with claims 2 and 4-6 which depend thereon, contain patentable and unobvious subject matter.

In view of the foregoing, it is respectfully requested that the claims be allowed and that this case be passed to issue.

Applicant also submits herewith a Second Supplemental
Information Disclosure Statement.

Respectfully submitted,
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Enclosures: Second Supplemental Information Disclosure Statement,
Form PTO-1449 with seven (7) references, International Search
Report, Copy of stamped postcard dated January 20, 2005
U.S. National Stage Worksheet, English translation of the
International Preliminary Examination Report, Check for \$180.00

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